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REVIEW OF THE EASTERN UNITED STATES SPECIES OF THE LEAF-FOLDING SAWFLIES OF THE GENUS *PHYLLOCOLPA* BENSON (HYMENOPTERA: TENTHREDINIDAE)

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Abstract.—Larvae of *Phyllocolpa* live and feed in leaf folds of *Salix* and *Populus.* The eight species from eastern United States are described, including ***P. eleanorae,* n. sp.**, reared from leaf rolls on *Salix* in New York. A key is given for species identification, and biological observations are presented for *Phyllocolpa eleanorae, P. leavitti* (Rohwer), *P. nigrita* (Marlatt), and *P. terminalis* (Marlatt), all on *Salix.* Lectotypes are designated for *Pontania robusta* Marlatt and *P. terminalis* Marlatt.

Key Words: Leaf-folding sawflies, *Phyllocolpa,* willow, *Salix,* poplar, *Populus*

Phyllocolpa, a genus in the Nematinae, includes 25 or more species in North America. Smith (1979) cataloged 26 species, but the genus has not been studied, and the catalog is simply a list of described species without regard to possible synonymy or potential distribution. In recent years, the junior author has been involved in biological studies of several species on *Salix* in New York. Because of the taxonomic status of the genus and absence of keys, identification of the species was impossible. Study of the eastern species of *Phyllocolpa* was therefore necessary, and a review is presented here. Eight species are now known from eastern United States, four of which were studied by the junior author, and one of them is newly described.

Few morphological characters are apparent to separate *Phyllocolpa* from related genera. Females are separated by the acuminate sheath (in lateral view usually emarginate ventrally with acute or rounded apex, always shorter than the hindfemur, Figs. 15–20) and males by the short fourth hindtarsal segment (shorter dorsally than apically). In *Pontania* Costa and related genera, the female sheath is broadly rounded at its apex, not emarginate ventrally, and usually longer than the hindfemur, and the fourth hindtarsal segment of the male is at least as long dorsally as apically. Males are most difficult to separate from members of other genera and sex associations are not known for all species, thus they are not treated here. In part, *Phyllocolpa* is also separated by larval habits. The larvae feed and develop in rolled leaves or leaf folds on *Salix* and *Populus.* In related genera, *Nematus* Panzer larvae feed externally on foliage of various hosts, most *Pontania* larvae form closed pea-shaped or bean-shaped leaf galls on *Salix* and *Populus,* and *Euura* Newman larvae form stem, twig, petiole, or bud galls on *Salix.*

Species now in *Phyllocolpa* were first recognized as a distinct group by Marlatt (1896a) who placed them in his Group I of

the genus *Pontania.* Ross (1929) gave the most recent review of this group for North America and called them *Pontania,* Group I of Marlatt (1896a). Ross (1929) described several new species, mostly from western North America, and gave a key to 15 species. Benson (1960a) treated this group of species in *Pontania,* but separated them into his Section A and formed two species groups within this section, the *leucosticta* group and *leucapsis* group. The groups were separated by the dull and pilose or shining and glabrous antennal hollows, respectively. Benson (1960b) described the genus *Phyllocolpa* for these species. Smith (1979) listed the North American species, including those already transferred to this genus by Benson (1960b) and additional ones, which where wrongly placed in other genera. Since Benson's (1960b) description, *Phyllocolpa* has been regarded as a distinct genus.

More recently, Goulet (1992) restricted *Phyllocolpa* to those species with an acuminate sheath (as in Figs. 19, 20); other species with a more rounded sheath go to *Pontania* in his key. Only the species *P. leavitti* and *P. nigrita* treated here would belong in *Phyllocolpa*; the others in *Pontania.* Zinovjev (1993) treated *Phyllocolpa* as a subgenus of *Pontania.* The subgenus *Phyllocolpa* included those species with the sawsheath in lateral view distinctly emarginate beneath an acute apex (as in Goulet's interpretation), always shorter than the hindfemur, and larvae in rolled leaves (or leaf margins) without swelling at the site of egg laying. *Pontania* included species with the sawsheath round and only sometimes slightly emarginate beneath the apex and larvae in closed galls or leaf rolls with the site of egg laying marked by distinct swelling on the upper surface of the leaf. He divided the subgenus *Phyllocolpa* into two species groups, the *piliserra* group, which lacks cerci at the apex of the 10th tergum in the larvae and has up to 8 larvae in a single leaf roll, and the *leucapsis* group, which have cerci in the larvae and only a single larva in a leaf roll. He also included some leaf-rolling species in the *crassispina* group of the subgenus *Pontania.* Zinovjev's classification is based on adult and larval characters, as well as habits and type of leaf-roll or gall; therefore, knowledge of the adults, larvae, and habits is necessary to place species properly. Immatures and habits of North American forms are very poorly known. When adequate information is available, some of the species treated here may require placement in other genera. For now, we prefer treating all species in the traditional *Phyllocolpa* of Benson (1960b) and Smith (1979).

Seven species of *Phyllocolpa* have been described from eastern North America (Smith 1979). It is possible some of those described from the West are transcontinental, but a survey of them indicated that they are not. No host or biological data were included with the descriptions of these seven species, except for *Phyllocolpa populi,* and most of the subsequent biological information of this and other species is from the work of H. G. Dyar (1897a, b); therefore, association of four species with *Salix* and biological observations by the junior author are significant. All species were described from females. Because of the difficulty to discriminate among males and presence of more distinct characters in the females, only females are treated here.

Voucher specimens are deposited in the National Museum of Natural History, Washington, DC. Biological notes on *Phyllocolpa eleanorae, P. leavitti, P. nigrita,* and *P. terminalis* are those of the junior author.

Key to Eastern United States Species of *Phyllocolpa*

1. Predominately orange, with black markings on dorsum of head, spots or streaks on mesonotum, and dorsum of abdomen (Figs. 1, 2, 8, 9) (apex of sheath rounded, Fig. 15) 2
– Predominately black, with pale-orange or yellowish areas mostly confined to orbits, supraclypeal area, pronotum, venter of abdomen,

and possibly spot or stripe on mesopleuron (Figs. 3–7, 10–14) 4
2. Antennal hollows glabrous and shining (Fig. 8); mesonotum with central black area covering posterior part of mesoprescutum and lateral areas of lateral lobes (ventral surface of mesothorax orange; on *Populus*) . . *robusta* (Marlatt)
– Antennal hollows dull and pilose (Fig. 9); mesonotum with three black spots or stripes, one on mesoprescutum and one on each lateral lobe 3
3. Ventral surface of mesoshorax orange as rest of underthorax; postocellar area black; postocellar area about 2.5× broader than long (Fig. 2) . . . . . *acuminata* (Marlatt)
– Ventral surface of mesothorax black; postocellar area orange (black only around and between ocelli); postocellar area about 3.0× broader than long . . . . . *pectoralis* (Marlatt)
4. Sheath in lateral view bluntly rounded at apex (Figs. 16–18) 5
– Sheath in lateral view acute at apex (Figs. 19–20) 7
5. Antennal hollows shining and not pilose; orbits broadly and supraclypeal area pale orange (Figs. 3, 10) (on *Salix*; mesopleuron possibly with central orange spot or stripe; pronotum mostly whitish except anterior margin) . . . . . *eleanorae,* n. sp.
– Antennal hollows dull and pilose; orbits, except possibly for spot on upper side, and supraclypeal area black (Figs. 4, 5, 11, 12) 6
6. Abdomen black; pronotum mostly black except for whitish posterior margin; on *Salix* . . . . . *terminalis* (Marlatt)
– Abdomen yellow ventrally; pronotum mostly pale orange to whitish except for anterior margin; on *Populus* . . . . . *populi* (Marlatt)
7. Abdomen black; orbits broadly orange (Figs. 6, 13); sheath straight above (Fig. 19); postocellar area short, nearly 3.0× broader than long (Figs. 6) . . . . . *nigrita* (Marlatt)
– Abdomen orange ventrally; orbits narrowly orange (Figs. 7, 14); sheath slightly emarginate above (Fig. 20); postocellar area longer, about 2.2× broader than long (Fig. 7) . . . . . *leavitti* (Rohwer)

Phyllocolpa acuminata (Marlatt)
(Figs. 2, 9)

Pontania acuminata Marlatt 1896a: 32. "One female. Michigan".—Benson 1960a: 380 (*leucosticta* group).

Phyllocolpa acuminata: Burks 1967: 22.—Smith 1979: 74.

Female.—Length, 5.0 mm. Antenna with scape and pedicel black (flagellum missing). Head orange with postocellar area black. Thorax orange with following black: spots on mesoprescutum and each mesonotal lateral lobe; posterior margin of mesoscutellum; posttergite; metanotum; mesepimeron; and metapleuron. Abdomen black dorsally, orange laterally and ventrally. Legs orange with hindtarsus and hindtibia blackish. Forewing with stigma and veins dark brown. Antennal hollows dull, finely punctate and pilose. Postocellar area 2.5× broader than long. Sheath in lateral view with narrowly rounded apex and slightly emarginate ventrally (as in Fig. 15).

Holotype.—U.S.N.M. type no. 1972, ♀, labeled "Ag. Coll. Mich. [= East Lansing], 5-20 '92, 168" and with Marlatt's determination label.

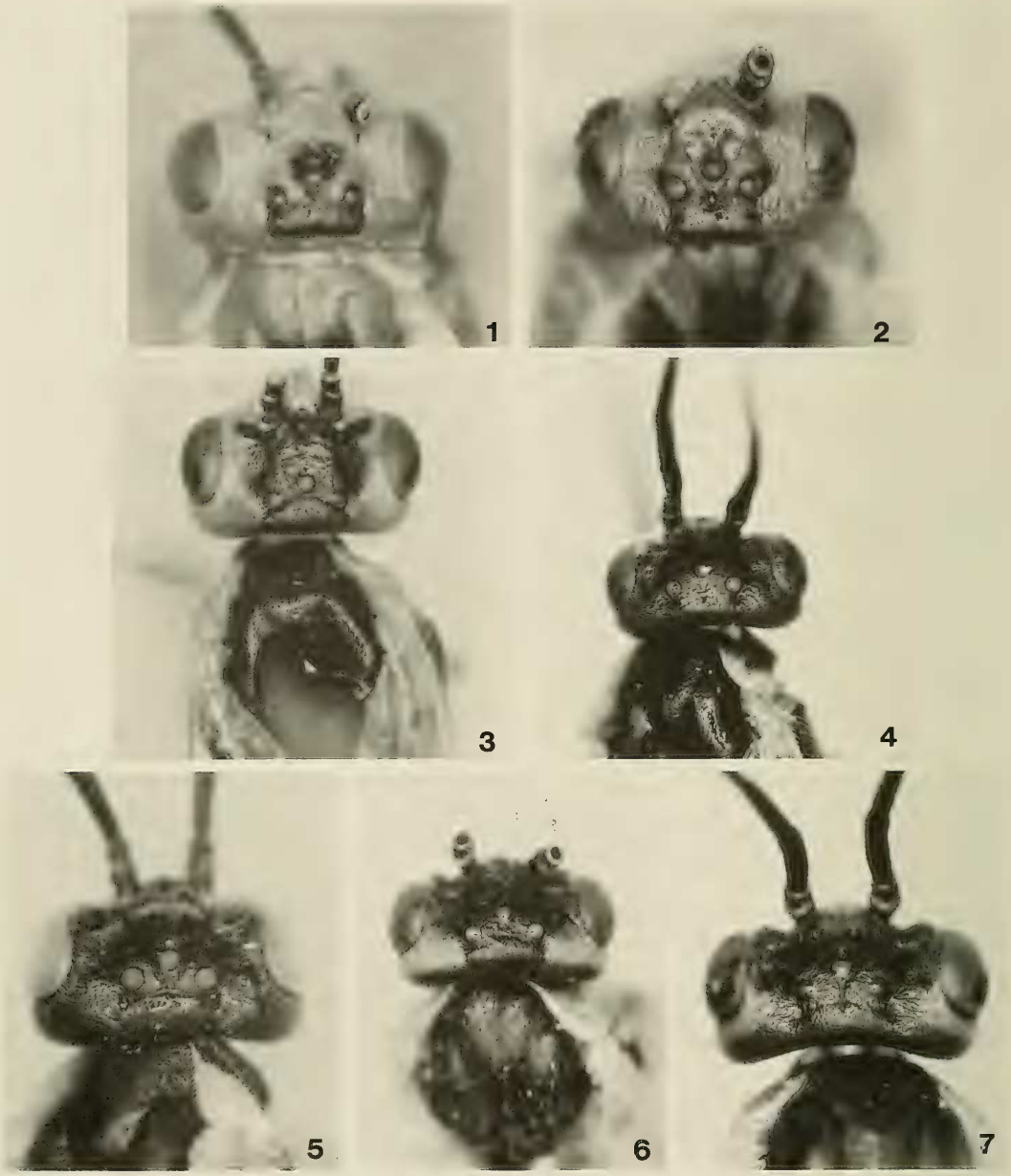
Distribution.—Michigan.

Host.—Unknown.

Discussion.—We saw only the holotype. The dull, pilose antennal hollows, longer postocellar area, and color as given in the key will separate *P. acuminata* from the other mostly orange species, *P. robusta* and *P. pectoralis.*

Phyllocolpa eleanorae Smith and Fritz, new species
(Figs. 3, 10, 16, 21)

Female.—Length, 4.3 mm. Antenna black above, pale orange below. Head black on dorsum and to antennae and with small black spot in tentorial pits; inner and outer orbits and supraclypeal area mostly orange, clypeus and mouthparts whitish. Thorax black with pronotum whitish and with tegula and sometimes faint spot on mesopleuron pale orange. Abdomen black dorsally, pale orange ventrally. Legs orange with basal half of hindcoxa black; hindtarsus slightly darker than femur and tibia. Forewing with costa, subcosta, and stigma pale amber, veins brownish. Antennal hollows shining and glabrous. Postocellar area short, slightly more than 3× broader than long. Mesopleuron shiny, without sculpture.



Figs. 1–7. Dorsal view of head and anterior thorax. 1, *Phyllocolpa robusta.* 2, *P. acuminata.* 3, *P. eleanorae.* 4, *P. terminalis.* 5, *P. populi.* 6, *P. nigrita.* 7, *P. leavitti.*

Sheath in lateral view narrowly rounded at apex, emarginate ventrally (Fig. 16).

Holotype.—♀, labeled "New York, Otsego [Co.], Milford, June 1989, *Salix sericea,* col. R. Fritz." In the National Museum of Natural History, Washington, DC.

Paratype.—NEW YORK: Same data as holotype (1 ♀). Deposited with the holotype.

Other specimens.—We examined about 25 additional specimens without host data from Maine, Michigan, New York, and Vermont but prefer to use only the reared specimens for the type series.

Hosts.—*Salix sericea* Marsh., *S. eriocephala* Michx., *S. discolor* Muhl.

Etymology.—Named for Eleanor Sosnowski who kindly allowed use of property for field studies by the junior author.

Discussion.—The bluntly rounded apex of the sheath, shining and glabrous antennal hollows, and coloration as given in the key will distinguish *P. eleanorae* from other mostly black *Phyllocolpa* species.

Biology.—*Phyllocolpa eleanorae* oviposits near the middle of the leaf fold (Fig. 21a) on the three willow species on which it oviposits (*Salix sericea, S. eriocephala,* and *S. discolor*). We have reared *Phyllocolpa eleanorae* only from *Salix sericea,* but we assume, based on similarity of the leaf folds, that it is the same species on *S. discolor* and *S. eriocephala.* On *Salix sericea,* the median egg location is at about 45% of the length of the leaf fold. On *Salix eriocephala* the median egg location is over 60% of the leaf fold length, but on *S. discolor* the median egg location is about 30% of the leaf fold length (Fritz and Kaufman 1993). On each of the willow species there is considerable variance in the location of the egg, and it may even be located in the same relative location as the eggs of *Phyllocolpa nigrita* (see below and Fig. 21c). A characteristic of the leaf folds of *Phyllocolpa eleanorae* that is useful in distinguishing them from *P. nigrita* is that the proximal edge of the fold is tightly curled over. *Phyllocolpa nigrita* folds flare out at the base near where the egg is located.

The last larval instar of *Phyllocolpa eleanorae* frequently consumes the tip of the leaf before dropping to the ground to pupate. A species of *Trichogramma* Westwood (Hymenoptera: Trichogrammatidae) is a major source of egg mortality for *Phyllocolpa eleanorae,* and mortality varies among the three willow species that have been studied (Fritz and Kaufman 1993).

Phyllocolpa leavitti (Rohwer)
(Figs. 7, 14, 20–22)

Pontania leavitti Rohwer 1910: 199. "Nerepis, New Brunswick. One female collected July 11 by A. G. Leavitt".—Ross 1929: 96 (*leaviti* [!]; in key).—Benson 1960a: 380 (*leucapsis* group).

Phyllocolpa leavitti: Burks 1967: 22.—Smith 1979: 75.

Female.—Length, 5.0–5.2 mm. Antenna and head black; eye orbits narrowly, supraclypeal area, clypeus, and mouthparts pale orange to whitish. Thorax black with posterior margin of pronotum and tegula pale orange. Abdomen black with venter pale orange. Legs pale orange. Antennal hollows dull and pilose. Postocellar area about 2× broader than long. Mesopleuron shiny, with only faint microsculpture. Sheath in lateral view acute at apex, upper margin very slightly concave, apicoventral margin concave (Fig. 20).

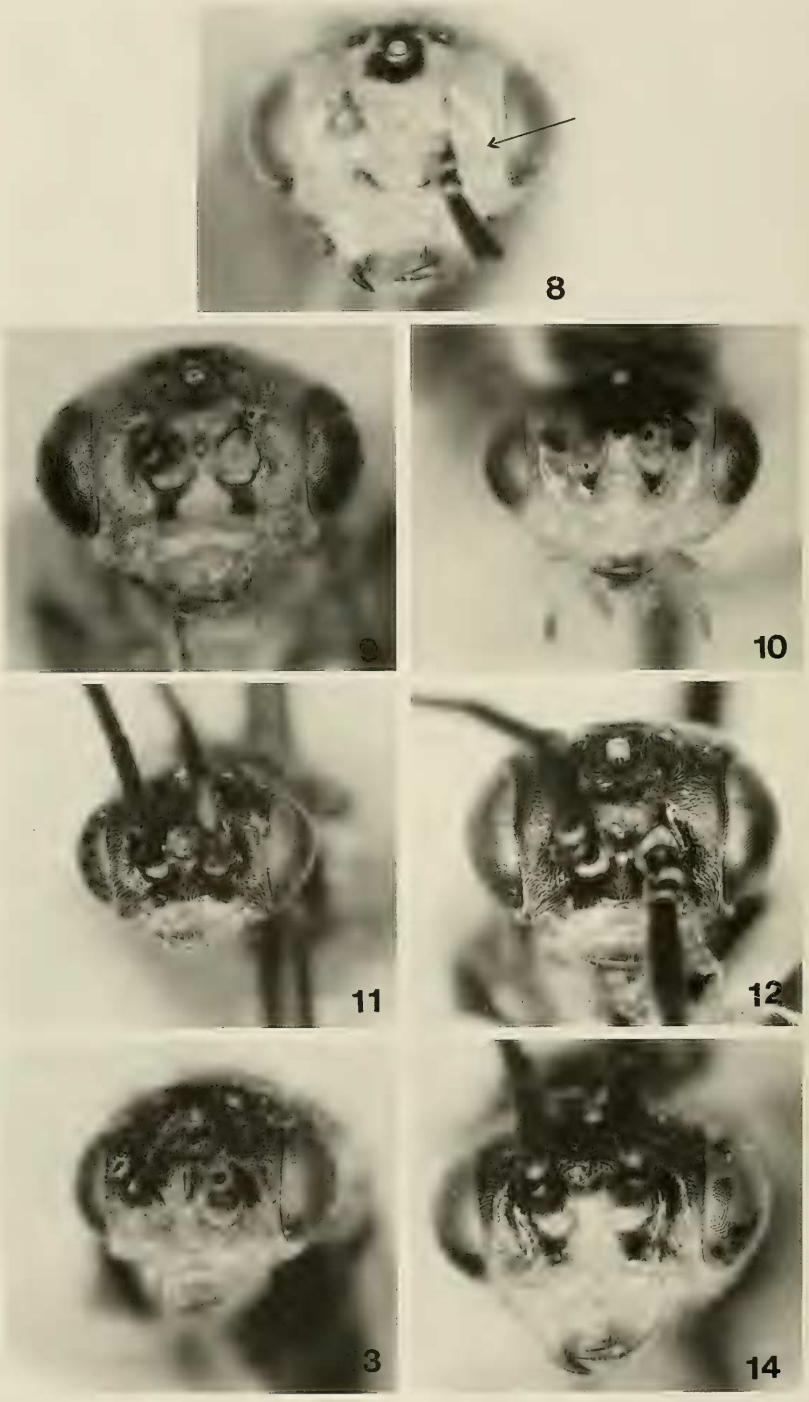
Holotype.—U.S.N.M. type no. 12921, ♀, labeled "Nerepis, NB, 11 Jul, AGLeavitt, Collector."

Distribution.—New Brunswick: Nerepis (holotype). New York: Otsego Co., Milford, June 1989, *Salix sericea,* R. Fritz; spiral Phyl., LS field, 6-20-89, R. Fritz. About 40 additional specimens from Maine, New Hampshire, New York, Quebec, and Vermont

Host.—*Salix sericea.*

Discussion.—The acute apex and emarginate ventral surface of the sheath places *Phyllocolpa leavitti* close to *P. nigrita,* but in *P. leavitti* the sheath is slightly emarginate above. Color differences are given in the key.

Biology.—A single specimen was reared from collections on *Salix sericea.* The leaf folds (Fig. 22) are similar to those of *Phyllocolpa terminalis* (Fig. 23) but appear to be distinguishable by the less smooth surface of the rolled leaf, which may be due to hypertrophication of the leaf blade where stung by the female sawfly. The leaf blade is not rolled as many times as in *Phyllocolpa terminalis,* only 0.5–1.5 times, and the egg is laid near the midvein, rather than near the edge of the blade (Fig. 21b).



Figs 8–14. Front view of head. 8, *Phyllocolpa robusta* (arrow indicates antennal hollow). 9, *P. acuminata.* 10, *P. eleanorae.* 11, *P. terminalis.* 12, *P. populi.* 13, *P. nigrita.* 14, *P. leavitti.*

Phyllocolpa nigrita (Marlatt)
(Figs. 6, 13, 19, 21)

Pontania nigrita Marlatt 1896a: 27. "One female. Michigan".—Ross 1929: 97 (in key).
Pontania pallicornis: Dyar 1897b: 196.
Phyllocolpa nigrita: Smith 1979: 75.
Phyllocolpa sp.: Smith 1987: 382 (Dyar's "71").

Female.—Length, 4.0–4.5 mm. Antenna mostly black, somewhat paler underneath. Head black; eye orbits broadly, supraclypeal area, malar area, clypeus and mouthparts pale orange. Thorax black with most of pronotum and tegula pale orange. Abdomen black. Legs pale orange with basal half of hindcoxa black. Antennal hollows dull, finely punctate and pilose. Postocellar area short, about 3× broader than long. Mesopleuron shiny, without sculpture. Sheath in lateral view with acute apex, slightly emarginate ventrally, straight dorsally (Fig. 19).

Holotype.—U.S.N.M. type no. 1909, ♀, labeled "Ag. Coll. Mich. [= East Lansing], 5-21-91, Ac. 190 Sp."

Distribution.—Michigan (holotype). New York: Van Cortlandt Park (H. G. Dyar); Otsego Co., Milford, *Salix sericea,* July 26, 1988, June 1989, R. Fritz (about 35 specimens). About 20 additional specimens from Michigan, New Hampshire, New York, and Virginia.

Host.—*Salix sericea, S. discolor, S. eriocephala.*

Discussion.—This species is close to *Phyllocolpa leavitti*; see key and notes under this species for separation.

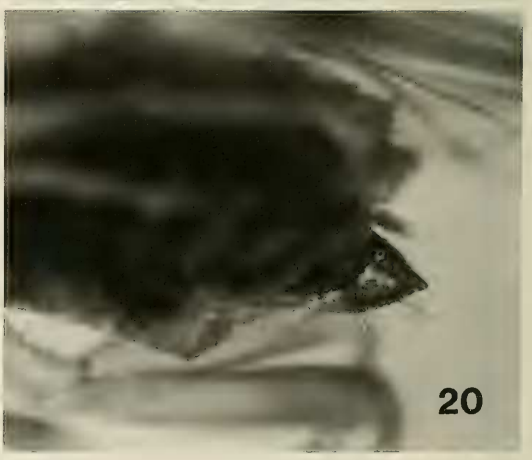
Biology.—One of Dyar's specimens labeled "71", was identified and described under the name *Pontania pallicornis* Norton (Dyar, 1897b, Smith, 1987). Dyar gave the following notes: "With the habits of *P. robusta* but living on the willow. The smooth leaves are closely folded over, the house long on the narrow leaf, 25 to 40 mm., about one-fourth of the leaf turned over, so that the outer edge just reaches the midrib. The folded part at the angle where it is bent is slightly swollen and yellowish, caused by little scattered patches eaten from the under side." "The larva comes out the apex of the house and eats the whole leaf. Single brooded; the larvae can be found till the middle of June. (Cocoons formed on the ground.) On the willow at Van Cortlandt Park, N.Y."

On both *Salix sericea* and *S. eriocephala,* the location of the oviposited egg is near the base of the leaf fold (Fig. 21c) (median egg position is 5% of the fold length) and there is less variation in egg location than for *Phyllocolpa eleanorae* (Fritz and Kaufman, 1993). On *Salix discolor* the median egg location is over 10% and there is more variation than on *S. eriocephala* and *S. sericea.* Egg mortality due to *Trichogramma* sp. is higher on *Phyllocolpa nigrita* than on *P. eleanorae.* This may be due to the increased exposure of the egg where the folded over leaf edge of the fold flares out (Fritz and Kaufman, 1993).

Phyllocolpa pectoralis (Marlatt)

Pontania pectoralis Marlatt, 1896a: 31. "One female. Algonquin, Ill."
Phyllocolpa pectoralis: Burks 1967: 22.—Smith 1979: 75.

Female.—Length, 5.0 mm. Antenna black, paler on undersurface and toward apex, especially apical 3–4 segments. Head orange with black only around and between hindocelli and spot anterior to front ocellus extending about half way to antennal insertions. Thorax orange with following black: cervical sclerites except small spot anteriorly; spots on mesoprescutum and each mesonotal lateral lobe; posterior margin of scutellum; posttergite; metanotum; ventral surface of mesothorax; lower half of mesepimeron; and metapleuron. Abdomen black dorsally and orange ventrally; basal 6 terga entirely black, remaining terga orange laterally; apical segment orange; terga with narrow, white posterior borders; sheath blackish dorsally, bottom half to two-thirds



Figs. 15–20. Lateral vew of apex of abdomen and sheath. 15, *Phyllocolpa robusta.* 16, *P. eleanorae.* 17, *P. terminalis.* 18, *P. populi.* 19, *P. nigrita.* 20, *P. leavitti.*

orange. Legs orange, basal half of hindcoxa black. Forewing with costa and stigma amber, apical half of stigma slightly more brownish; veins brownish. Antennal hollow somewhat shining but with fine punctures and pilose between hollows and eyes. Postocellar area little more than 2× broader than long. Sheath in lateral view narrowly rounded at apex, slightly concave ventrally (as in Fig. 15).

Holotype.—At Cornell University (Hoebeke 1980), ♀ labeled "Algonquin, III.," "4425," "Pontania pectoralis Marlatt, type," "Cornell U. Lot 187, sub. 51a," "Type Cornell U. No. 4522."

Distribution.—Illinois.

Host.—Unknown.

Discussion.—We have seen only the holotype. The species is separated from other orange species by the dull and pilose antennal hollows, mesonotum with three black spots, black ventral surface of the mesothorax, orange postocellar area, and the postocellar area about three times broader than long.

Phyllocolpa populi (Marlatt)
(Figs. 5, 12, 18)

Pontania populi Marlatt, 1896b: 253. "Described from a single female, reared by H. G. Dyar, from larva collected in New York." ". . . on *Populus grandidentata*".—Dyar 1897a: 24.—Benson 1960a: 380 (*leucosticta* group).

Phyllocolpa populi: Burks 1967: 22.—Smith 1979: 75.—Smith 1987: 382.

Female.—Length, 4.8–5.4 mm. Antenna and head black; light orange spot on upper inner orbit. Thorax black with most of pronotum and tegula pale orange. Abdomen black dorsally, pale orange ventrally. Legs pale orange with base of hindcoxa black and hindtarsus darker than femur and tibia. Forewing with stigma and veins light brown. Antennal hollows dull and pilose. Postocellar area about 2.3× broader than long. Mesopleuron shiny, without sculpture. Sheath in lateral view pointed at apex, not distinctly emarginate ventrally (Fig. 18).

Holotype.—U.S.N.M. type no. 3474, ♀, labeled "7H", "N.Y. Coll. H.G. Dyar" "reared from larva on Populus grandidentata." This specimen bears the type label and Marlatt's determination label, and is presumably the only specimen Marlatt examined. There are four other females in the collection from Dyar's "7H" rearings.

Distribution.—We examined about 55 specimens from Connecticut, Maryland, Massachusetts, New Jersey, New York, Ontario.

Host—*Populus grandidentata* Michx.

Discussion.—This species and *Phyllocolpa robusta* are the only species with larvae feeding on poplar. The coloration and sheath shape as given in the key and as described and illustrated will distinguish this species. The sheath is not emarginate ventrally as in most other *Phyllocolpa* species.

Biology.—Dyar's 7H code refers to specimens from Fort Lee, N.J. (Smith 1987). Dyar (1897a) described the larva and gave the following notes: ". . . forms at first a small gall, but soon the leaf rolls over, gall and all, forming two or three turns and the larva lives in the tube so formed, without spinning any sort of web." "The larva remains in the gall up to as late as the fourth stage, but is usually out to feed in the third. It may be in the rolled part permanently in stage IV." "The larvae never eat the whole leaf, but the parenchyma only, even in the last stage. They spin small brown cocoons." "Found on *Populus grandidentata* at Fort Lee, N.J. There is more than one brood in the season, the larvae infesting the successive leaves of young shoots."

Several specimens were reared from *Populus grandidentata* at East River, Connecticut. They are under Hopkins' No. 10746b, and notes associated with this are as follows: "Sawfly larvae feeding on young leaves of *Populus grandidentata.* The larvae roll the edge of the leaf and feed within the roll. In most cases the rolling of the leaf appears to be caused in the first

place by a gall and as no very young larvae were found in the rolls it is thought possible that the earliest stage or stages may be passed within the gall." Larvae were collected July 7 to 15, 1915. By July 23 most larvae had cocooned. Several adults emerged July 24 and August 6, 1915.

Other specimens from Massachusetts, New Jersey, Connecticut, and Ontario bear host labels either as *Populus* sp. or *Populus grandidentata.*

Phyllocolpa robusta (Marlatt)
(Figs. 1, 8, 15)

Pontania robusta Marlatt 1896a: 32. "One female and one male. Michigan and District of Columbia (?)".—Dyar 1897b: 195.—Benson 1960a: 381 (*leucapsis* group).

Phyllocolpa robusta: Burks 1967: 22.—Smith 1979: 75.—Smith 1987: 381.

Female.—Length, 5.0 mm. Antenna with scape, pedicel and first flagellar segment black above, orange underneath (rest of flagellum missing). Head orange with postocellar area and circle around front ocellus black. Thorax orange with following black: central spot on mesonotum covering apex of mesoscutellum and medial portion of each lateral lobe; narrow longitudinal median stripe on mesoscutellum, posterior margin of mesoscutellum, and posttergite; and metanotum. Abdomen black dorsally, orange laterally and ventrally; apex of sheath black. Legs orange. Forewing with costa, subcosta, and stigma pale amber, veins brownish. Antennal hollows shiny and glabrous. Postocellar area short, about 3× broader than long. Mesopleuron shiny. Sheath in lateral view narrowly rounded at apex, emarginate ventrally (Fig. 15).

Male.—Length, 4.7 mm. Similar to female except thorax black with broad orange steak on mesopleuron, pronotum mostly orange, and legs orange with basal third of hindcoxa black.

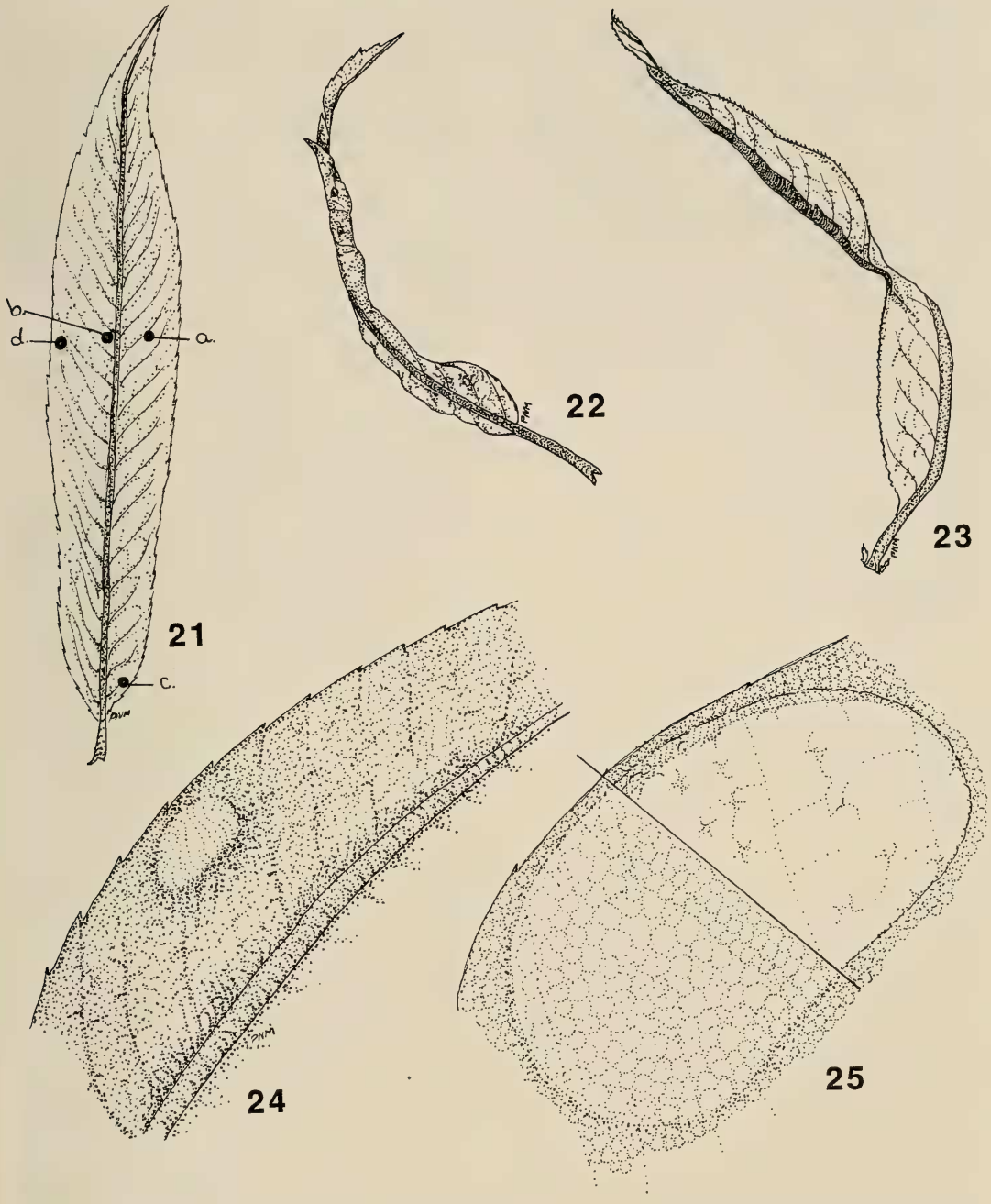
Lectotype.—By present designation, the lectotype is the female described by Marlatt, and labeled "Ag. Coll. Mich. [= East Lansing], 5-30-92, 193" "Type No. 1913, U.S.N.M." and with Marlatt's determination label. The male from the District of Columbia (?) is labeled "Collection C.V. Riley." It is not *P. robusta,* and we doubt that it is from the District of Columbia; therefore, we are not considering it a paralectotype.

Distribution—Michigan (lectotype), New Jersey (3 specimens reared by H. G. Dyar).

Host.—*Populus tremuloides* Michx.

Discussion.—The predominately orange coloration and glabrous and shining antennal hollows separate *Phyllocolpa robusta* from other mostly orange *Phyllocolpa* species.

Biology.—Dyar reared this species under his code "7F" (Smith, 1987); two females and one male are from his rearings. The females compare favorably with Marlatt's type female except for a larger black spot on the ocellar area, but the male associated is clearly different than that described by Marlatt from the specimen from the District of Columbia(?). Dyar's association by rearing precludes Marlatt's male from being the male of *P. robusta.* Dyar (1897b) gave the following notes: "No gall, but a portion of the leaf simply folded over. The egg is deposited under the lower epidermis near the edge, not far from the petiole. The larva eats little patches of the parenchyma on the under side scattering three-fourths of the way to the apex, apparently while the leaf is young; these patches are slightly swollen, discolored, pale, and as a result the outer fourth of the leaf folds back, nearly touching the surface, forming a hollow in which the larva lives. Finally the larva eats the whole leaf, emerging from its house and eating the apex of the leaf to return to the house again after feeding. The leaf is not rolled at all, simply folded. Fresh eggs were found May 9th. At that time the young leaf was nearly folded back though not fully grown. On expanding the folded part it was seen to be slightly larger than normal, forming a lobe on the leaf. The egg was situated



Figs. 21–25. 21, Willow leaf outline with oviposition sites for a) *Phyllocolpa eleanorae,* b) *P. leavitti,* c) *P. nigrita,* and d) *P. terminalis.* 22, Leaf fold of *P. leavitti*; note that midvein forms a spiral and the surface of the leaf fold is not smooth. 23, Leaf fold of *P. terminalis*; the midvein forms a spiral, but the leaf surface is usually smooth. 24, Depiction of the small gall of *Phyllocolpa terminalis* that forms on the upper leaf surface of the willow leaf before the leaf blade rolls tightly. 25, Appearance of the under leaf surface of the mined gall of *P. terminalis* with the epidermis intact (left) and with the epidermis removed (right). The inside of the mined gall reveals large, light green cells of hypertrophied mesophyll.

under the lower epidermis, elliptical, white, .4 × .8 mm." "The larva eats the whole leaf when it emerges, sitting on the edge, the body curled down a little on one side of the leaf. The larvae will rasp with their prongs in the houses if disturbed. At the end of the stage the larvae enter the ground." "Found on the small leaved poplar (*Populus tremuloides*) at Fort Lee, N.J. I have also seen the characteristic houses on the poplar near New York City and at Jefferson, NH. There is only one brood a year, the larvae disappearing at the end of May or a little later. The houses remain on the tree much longer. Cocoons formed on the ground."

Phyllocolpa terminalis (Marlatt)
(Figs. 4, 11, 17, 21, 23–25)

Pontania terminalis Marlatt, 1896b: 253. "Described from three females and two males reared by H. G. Dyar, from imperfect galls in the partly-rolled terminals of willow leaves. Specimens collected near New York City".—Dyar 1897a: 24.—Benson 1960a: 380 (*leucosticta* group).
Phyllocolpa terminalis: Burks 1967: 23.—Smith 1979: 75.—Smith 1987: 382.

Female.—Length, 4.7–5.0 mm. Antenna black. Head black with upper outer and/or inner orbits sometimes narrowly brownish; clypeus and mouthparts whitish. Thorax black with pronotum and tegula pale orange. Abdomen black. Legs pale orange with basal half of hindcoxa black. Forewing with veins and stigma light brown. Antennal hollows dull and pilose. Postocellar area short, about 3× broader than long. Mesopleuron shiny, without sculpture. Sheath in lateral view with narrowly rounded apex, straight dorsally, slightly emarginate ventrally (Fig. 17).

Lectotype.—Here designated, a female labeled "7K" "N.Y., H.G. Dyar" "Type No. 3473 U.S.N.M." and with Marlatt's determination label. A male is also labeled as type by Marlatt. Four other specimens (3 F and 1 M) are also in the collection, all from the same rearings labeled "7K." The male and two of the females must be part of the type series. Two males and two females labeled "7K" are designated paralectotypes.

Distribution.—New York: New York City (lectotype and paralectotypes, reared by H. G. Dyar); Otsego Co., Milford, *Salix sericea,* June 1989, June 1990, R. Fritz (5 specimens). About 15 additional specimens from New Hampshire, New York, and Vermont.

Host.—*Salix sericea.*

Discussion.—The sheath is similiar to that of *Phyllocolpa populi,* but the pronotum is mostly black, the abdomen is black, and the larvae feed on *Salix,* not *Populus.*

Biology.—Dyar's "7K" rearings were from Van Cortlandt Park, New York City (Smith, 1987). Dyar (1897a) described the larva and gave the following notes: "Egg deposited under the lower epidermis forming a small gall-like swelling. . . . A green elevation of the upper surface; below a thin skin, not swollen, but slightly yellowish; the leaf rolls over tightly in a close coil to two whole turns, finally as far as the midrib, from one half to the whole of one side of the leaf being involved. The little larva lives in the gall, but soon comes out of it and rests in the rolled part." "Found on willow at Van Cortlandt Park, New York City."

Our observations of the galls of *Phyllocolpa terminalis* coincide closely with those of Dyar. Eggs are oviposited near the middle of the leaf (Fig. 21d), and, after a few days, a small gall is formed (Figs. 24). When the egg hatches, the larva lives inside the leaf tissue of the gall mining a portion of the gall (Fig. 25) before emerging into the tightly rolled leaf fold (Fig. 23). The leaf edge is rolled over from 1.0 to 3.5 times, and the rolled edge can extend across the midvein. Sometimes the opposite leaf edge is also rolled from 0.5 to 3.0 times, but there is no egg oviposited and often soiling of the opposite edge does not occur. We presume that the female sawfly causes both of the leaf edges to curl over due to

stinging both sides of the leaf blade. As a result of the curled-over leaf edge, the midvein of the leaf forms a a loose spiral form. The surface of the leaf fold is distinctly smoother than the leaf folds of *P. eleanorae, P. nigrita,* and *P. leavitti.*

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